

## CLAIMS

- [1] A method for producing a non-oxide ceramics having an oxide layer on its surface by oxidizing the surface of a non-oxide ceramics, characterized in that
- 5 said method comprises the steps of:
- (1) providing a non-oxide ceramics;
  - (2) introducing said non-oxide ceramics into a furnace, then discharging an oxidizing substance adsorbed or sorbed to said non-oxide ceramics or to a material constituting the furnace
  - 10 outside of the furnace, so as to reduce an oxidizing gas content in the atmosphere within the furnace to be not more than 0.5 mmol in terms of total number of moles of the oxidizing gas per m<sup>3</sup> of the inside of the furnace;
  - (3) heating said non-oxide ceramics to a temperature at or above
  - 15 a temperature, which is 300°C below the oxidation start temperature of said non-oxide ceramics, while maintaining the atmosphere in the furnace having an oxidizing gas content of not more than 0.5 mmol in terms of total number of moles of the oxidizing gas per m<sup>3</sup> of the inside of the furnace; and
  - 20 (4) brining the non-oxide ceramics heated in said step (3) into contact with an oxidizing gas and then holding the non-oxide ceramics at a temperature above the oxidation start temperature of said non-oxide ceramics to form an oxide layer on the surface of said non-oxide ceramics, and that

when bringing said non-oxide ceramics into contact with said oxidizing gas in said step (4), after the contact of said non-oxide ceramics and said oxidizing gas, until at least 2 min. elapses after the arrival of the temperature of said non-oxide ceramics at or above the oxidation start temperature thereof, the pressure or partial pressure of the oxidizing gas is maintained at not more than 50 kPa.

[2] A non-oxide ceramics having an oxide layer on its surface, characterized by comprising a non-oxide ceramics of a nitride or carbide of a metal or semimetal and a 0.1 to 100  $\mu\text{m}$ -thick oxide layer provided on said surface of said non-oxide ceramics, said oxide being an oxide of an element identical to said metal or semimetal element, voids being substantially absent in said oxide layer in its region in a thickness of at least 20 nm from the boundary of said non-oxide ceramics and said oxide layer.

[3] The non-oxide ceramics having an oxide layer on its surface according to claim 2, characterized in that, when a branched crack is divided into a crack unit located between adjacent branch points and crack units extending from the crack end to the nearest branch point, a branched crack having a crack unit simultaneously having a  $w$  value of not less than 20 nm, an  $l$  value of not less than 500 nm and a  $w/l$  value of not less than 0.02, wherein  $l$  (nm) represents the length of each crack

unit, and  $w$  (nm) represents the maximum width of each crack unit, is substantially absent on the surface of the oxide layer.

[4] The non-oxide ceramics having an oxide layer on its surface according to claim 2 or 3, wherein said non-oxide  
5 ceramics is comprised of a sintered aluminum nitride, and the oxide layer consists essentially of polycrystalline  $\alpha$ -alumina.

[5] A non-oxide ceramics having an oxide layer on its surface produced by the method according to claim 1.

10 [6] A cooling device comprising: an exothermic element; a cooling jacket formed of the non-oxide ceramics having an oxide layer on its surface according to any one of claims 2 to 5; and cooling medium feeding means, wherein said exothermic element and the cooling jacket come into thermal contact with  
15 each other, a cooling medium is fed from said cooling medium feeding means into said cooling jacket, and an oxide layer is provided on the surface of said cooling jacket at least on its side which comes into contact with said cooling medium.

[7] A plasma resistant member comprising the non-oxide  
20 ceramics having an oxide layer on its surface according to any one of claims 2 to 5.

[8] The plasma resistant member according to claim 7, which is a member for constituting a chamber in a semiconductor or liquid crystal production apparatus comprising a plasma

production mechanism.

[9] The plasma resistant member according to claim 8,  
which is a wafer holder.

[10] The plasma resistant member according to claim 9,  
5 which is a window material for high frequency wave  
introduction.